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(54) **METHOD AND SYSTEM FOR DETECTING ALARM SYSTEM TAMPERING**

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CPC ..... ***G08B 29/12*** (2013.01); ***G08B 25/007*** (2013.01)

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See application file for complete search history.

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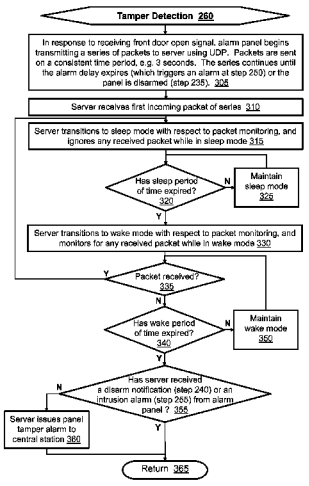
(57) **ABSTRACT**

An alarm system monitors a home, business, or other property for fire, burglary, break-in, or other event that may warrant raising an alarm. The alarm system is configured to detect tampering, whereby someone intentionally impedes the ability of the system to raise an alarm or otherwise interferes the system's operation. An alarm panel of the alarm system communicates with a server. At certain times, the alarm system transmits a series of packets to the server using a unidirectional protocol. Upon receipt of one of the packets, the server alternates between monitoring for an incoming packet and ignoring any incoming packets. Detection of an incoming packet during a monitoring time period causes the server to transition to ignoring packets for a sleep period of time. Completion of the sleep period of time causes the server to return to monitoring for the monitoring period of time.

**20 Claims, 3 Drawing Sheets**



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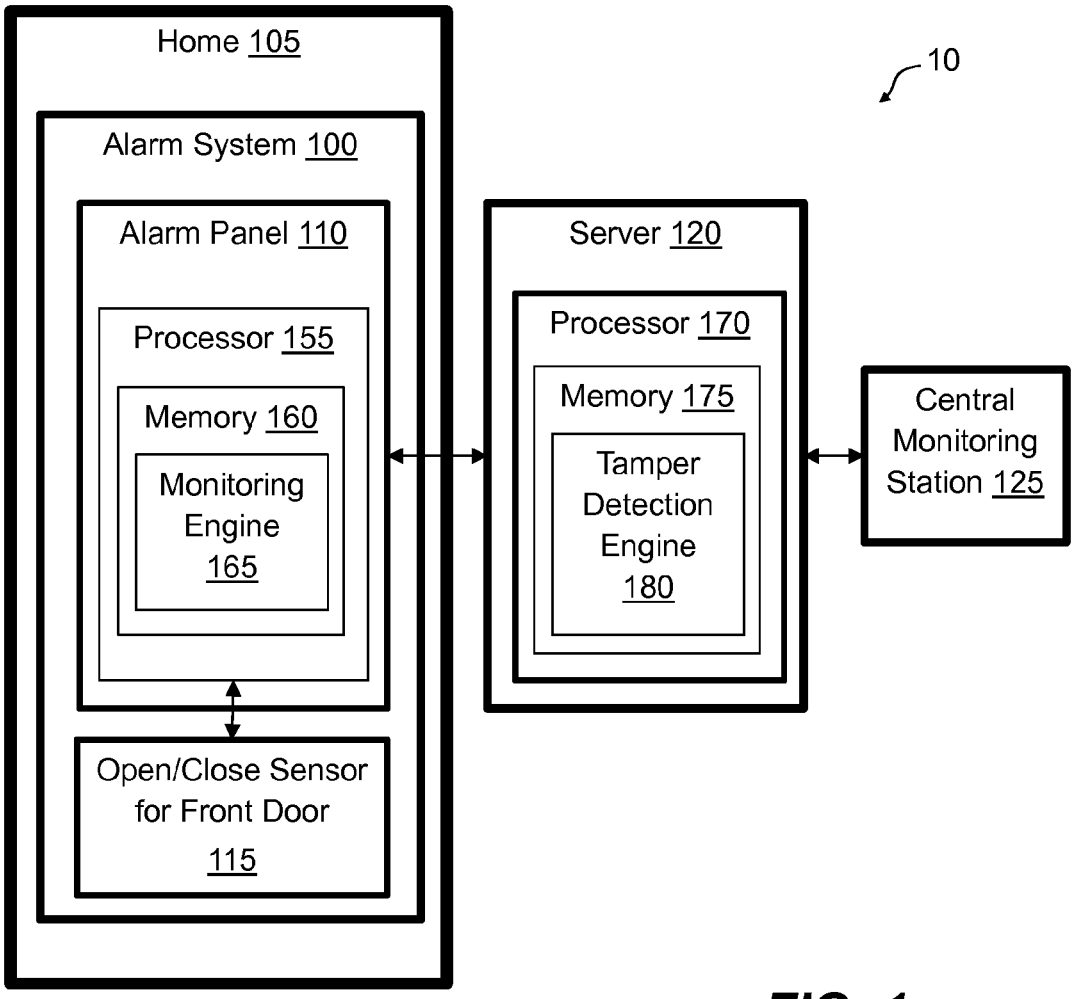
Home 105
10
Alarm System 100
Alarm Panel 110
Processor 155
Memory 160
Monitoring Engine 165
Server 120
Processor 170
Memory 175
Tamper Detection Engine 180
Central Monitoring Station 125
Open/Close Sensor for Front Door 115

FIG. 1

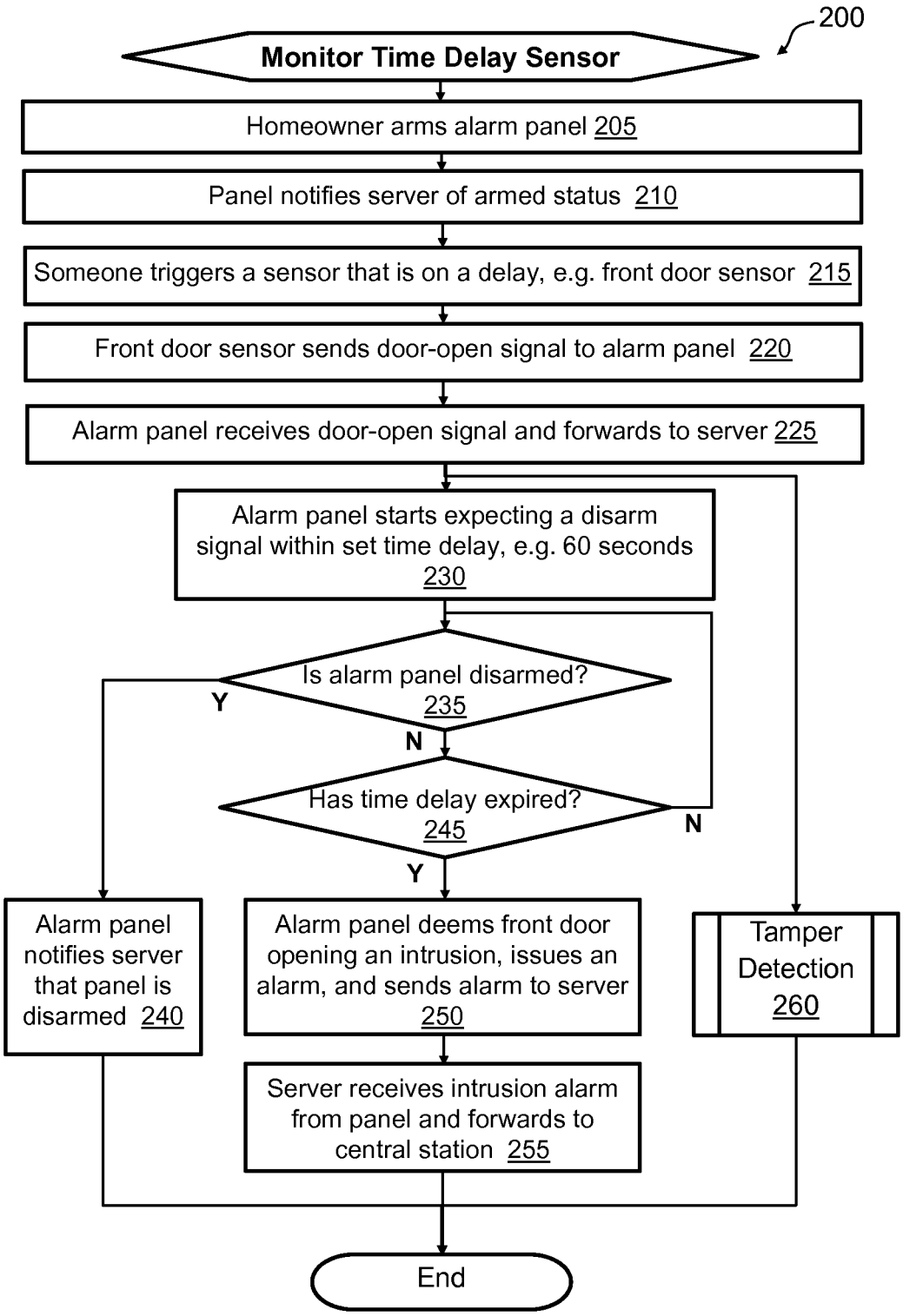
200
Monitor Time Delay Sensor
Homeowner arms alarm panel 205
Panel notifies server of armed status 210
Someone triggers a sensor that is on a delay, e.g. front door sensor 215
Front door sensor sends door-open signal to alarm panel 220
Alarm panel receives door-open signal and forwards to server 225
Alarm panel starts expecting a disarm signal within set time delay, e.g. 60 seconds 230
Is alarm panel disarmed? 235
Y
N
Has time delay expired? 245
N
Y
Alarm panel notifies server that panel is disarmed 240
Alarm panel deems front door opening an intrusion, issues an alarm, and sends alarm to server 250
Tamper Detection 260
Server receives intrusion alarm from panel and forwards to central station 255
End

FIG. 2

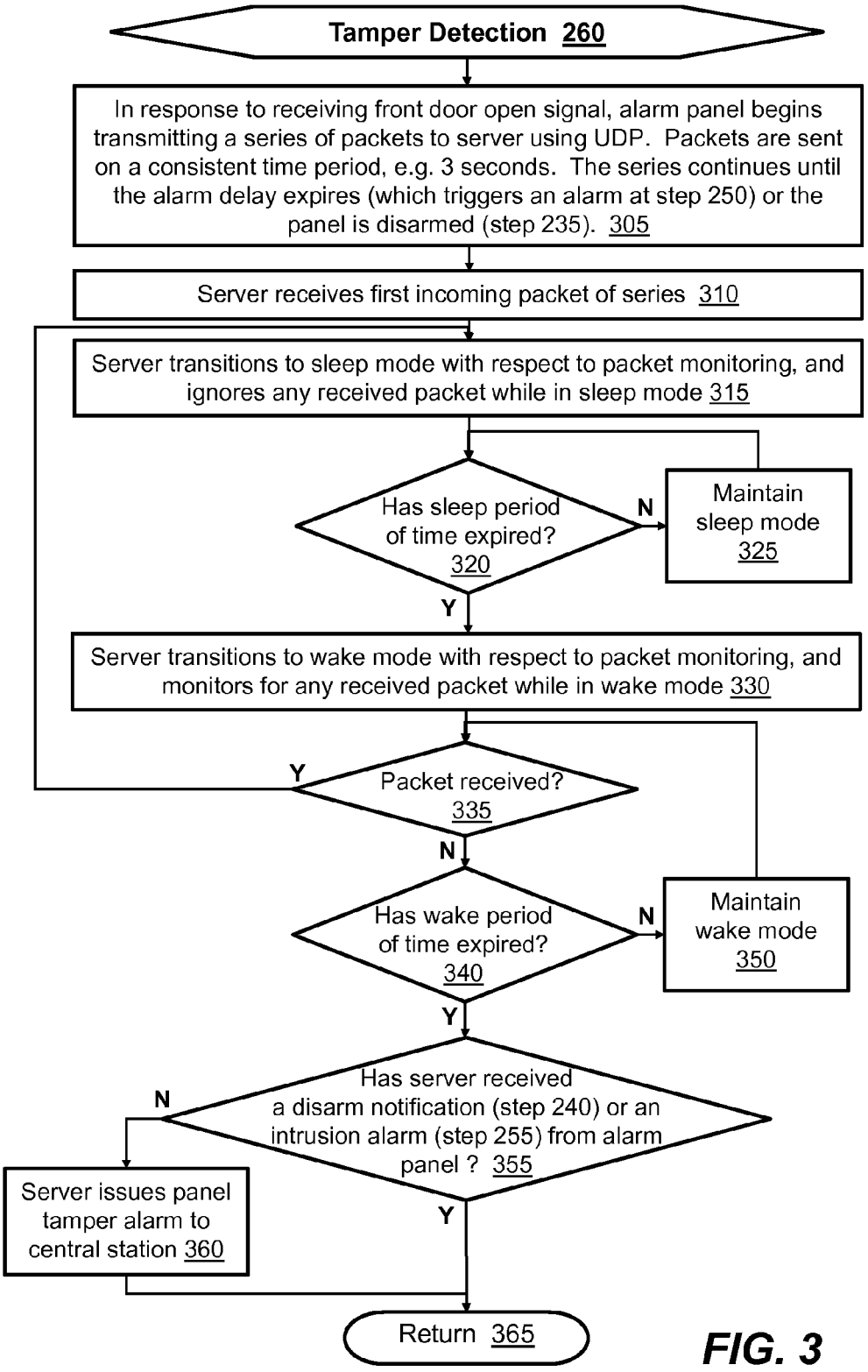
Tamper Detection 260
In response to receiving front door open signal, alarm panel begins transmitting a series of packets to server using UDP. Packets are sent on a consistent time period, e.g. 3 seconds. The series continues until the alarm delay expires (which triggers an alarm at step 250) or the panel is disarmed (step 235). 305
Server receives first incoming packet of series 310
Server transitions to sleep mode with respect to packet monitoring, and ignores any received packet while in sleep mode 315
Has sleep period of time expired? 320
N
Maintain sleep mode 325
Y
Server transitions to wake mode with respect to packet monitoring, and monitors for any received packet while in wake mode 330
Y
Packet received? 335
N
Has wake period of time expired? 340
N
Maintain wake mode 350
Y
N
Has server received a disarm notification (step 240) or an intrusion alarm (step 255) from alarm panel ? 355
Server issues panel tamper alarm to central station 360
Y
Return 365

FIG. 3

# METHOD AND SYSTEM FOR DETECTING ALARM SYSTEM TAMPERING

## TECHNICAL FIELD

The present technology relates generally to alarm systems and more particularly to detecting when someone is tampering with an alarm system.

## BACKGROUND

A typical alarm system can monitor a home, business, or other property for fire, burglary, break-in, or other event that may warrant raising an alarm. However, alarm systems can be susceptible to tampering, whereby someone intentionally interferes the ability of the alarm system to raise an alarm or otherwise suppresses the alarm system's defenses. Accordingly, there are needs in the art for technologies that can detect and combat alarm system tampering.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is functional block diagram of a system for monitoring premises for alarm events according to certain embodiments.

FIG. **2** is a flowchart of a process for alarm monitoring according to certain embodiments.

FIG. **3** is a flowchart of a process for detecting alarm system tampering according to certain embodiments.

Many aspects of the technology can be better understood with reference to the above drawings. The elements and features shown in the drawings are not necessarily to scale, emphasis being placed upon clearly illustrating the principles of exemplary embodiments of the present technology. Moreover, certain dimensions may be exaggerated to help visually convey such principles.

## DETAILED DESCRIPTION

An embodiment of a computer-based system and process for detecting and reporting tampering of an alarm system will be discussed in further detail below with reference to the figures. However, the present technology can be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the technology to those having ordinary skill in the art. Furthermore, all "examples," "embodiments," "example embodiments," or "exemplary embodiments" given herein are intended to be non-limiting and among others supported by representations of the present technology.

Certain embodiments comprise or involve processes that will be discussed below. Some process steps may naturally need to precede others to achieve intended functionality or results. However, the technology is not limited to the order of the steps described to the extent that reordering or re-sequencing does not render the processes useless or nonsensical. Thus, it is recognized that some steps may be performed before or after other steps or in parallel with other steps without departing from the scope and spirit of this disclosure.

FIG. **1** illustrates a functional block diagram for a representative operating environment **10** for an alarm system **100**. In the operating environment **10**, the alarm system **100** monitors a premises, in this case a business or home **105**. An alarm panel **110** of the alarm system **100** receives signal



inputs from sensors that detect events or conditions that may warrant issuance of an alarm. Such sensors are represented in FIG. **1** by an open/close sensor **115** for a front door.

The alarm panel **110** communicates with a remote, off-premises server **120** that functions as an alarm gateway for multiple other alarm systems at other premises (not illustrated) and provides connectivity to a central monitoring station **125**. The central monitoring station **125** monitors the alarm systems and is staffed with people who can dispatch emergency services, such as police and fire responders, on an as-needed basis.

As discussed above, the alarm system **100** includes one or more sensors for detecting various types of alarm events, such as fire, burglary, or medical emergency. Such sensors may include wired and/or wireless magnetic window and door sensors (e.g. the front door sensor **115** illustrated in FIG. **1**), glass-break sensors, infra-red sensors, motion sensors, smoke detectors, and carbon monoxide sensors. The sensor suite in any particular installation may be dictated by the alarm supplier and the owner of the home/premises **105** that is monitored by the alarm system **100**. The alarm system **100** may further include one or more sirens, speakers, and microphones for sounding an alarm, capturing sounds within the home/premises **105**, and amplifying a voice of an agent who is in the central monitor and communicating remotely.

The alarm panel **110** typically includes a display providing a current status of the alarm system **100** and a keypad including buttons and/or other controls to configure and interface with the alarm system **100**. A user of the alarm system **100** is able to determine a current status of the alarm system **100** by viewing the display of the alarm panel **110**, and may arm and disarm the system through the panel **110**. The user may also call for fire, police, and medical emergency personnel using the keypad of the alarm panel **110**. The alarm system **100** further includes other wiring and associated circuitry typical of alarm systems.

The alarm panel **110** typically comprises a communication module (not illustrated) for providing a wireless or wired transceiver with circuitry and associated software for establishing data and voice channels. Particularly, the communication module can be configured to establish data and voice channels with the server **120** via a communication path. In operation, the alarm system **100** can detect an alarm event using one or more of the sensors and communicates associated alarm event data to the server **120** using a wired or wireless data channel. The alarm system **100** may also utilize a voice channel between the alarm system **100** and the central alarm monitoring station **125**.

The alarm panel **110** comprises a processor **155** that typically includes one or more microprocessors or microcontrollers and associated memory **160**. Example embodiments of the memory **160** can comprise volatile and non-volatile memory, such as random access memory (RAM) and flash memory for example. In an example embodiment, the memory **160** can comprise firmware for executing management and control functions. For example, the memory **160** can comprise persistent memory that stores program code, including a monitoring engine **165**. An embodiment of the monitoring engine **165** comprises computer executable instructions for making alarm decisions based on input from the front door sensor **115** and other sensors, such as code for the appropriate portions of process **200** and process **260** that are illustrated in flowchart form in FIGS. **2** and **3** and discussed below.

As discussed above, the server **120** provides a gateway between multiple alarm systems **100** and the central monitoring station **125**. More specifically, the server **120** provides

and facilitates alarm monitoring services for multiple alarm systems at various homes and businesses in addition to the illustrated alarm system **100**. The server typically comprises a communication module (not illustrated) that establishes data and voice channels with the alarm panel **110** via a bidirectional communication link that may be wired or wireless. In operation, the server **120** receives alarm event data representative of an alarm event from the alarm system **100** and forwards the alarm event data along with associated information to the central monitoring station **125**.

The server **120** comprises a processor **179** that typically includes one or more microprocessors or microcontrollers and associated memory **180**. Example embodiments of the memory **175** can comprise volatile and nonvolatile memory, such as random access memory (RAM) and flash memory for example. In an example embodiment, the memory **175** can comprise firmware for executing management and control functions. For example, the memory **175** can comprise persistent memory that stores program code, including a tamper detection engine **180**. An embodiment of the tamper detection engine **180** comprises computer executable instructions for identifying and acting on tamper events, such as code for appropriate portions of processes **200** and **260** that are illustrated in flowchart form in FIGS. **2** and **3** and discussed below.

The central monitoring station **125** typically includes at least one agent console and associated communications and computing gear. Personnel, including agents, staff the central monitoring station **125**. In a typical operation, each agent is able to view an agent console, which displays information associated with received alarm event data from alarm systems. After receiving alarm event data and associated information from the alarm system **100** and the server **120**, the agent console may display details related to an alarm event occurring at the home **105** where the alarm system **100** is installed. For example, based on alarm event data received from the alarm system **100**, the agent console may indicate that a fire, panic, burglary, or medical emergency is occurring where the alarm system **100** is installed. Additionally, the agent console may display a street address or geographic coordinates of the home **105** and contact information for fire, police, and medical services. Based on the display, the agent is able to assess the event where the alarm system **100** is installed. Thus, the central monitoring station **125** facilitates monitoring alarm systems installed at multiple locations by agents who assess alarm events, and when deemed appropriate, may contact service personnel based upon alarm event data received from the alarm systems. For example, agents monitoring the alarm system **100** at the central monitoring station **125** may call for fire, police, or medical service personnel to be dispatched to the home **105**.

FIG. **2** illustrates a flowchart of a representative process **200** for alarm monitoring. Process **200** specifically describes handling a situation in which a sensor that is on a time delay, such as the front door sensor **115**, has been tripped. While process **200** will be discussed with the example of the front door sensor **115** being on a time delay, other alarms applications and installations will incorporate other sensors that utilize an alarm delay. That is, the front-door-open signal is one example embodiment of a security-zone-open signal. Accordingly, process **200** is equally applicable to any sensor or security zone that has an associated time delay. When the homeowner or other legitimate user opens the front door of the home **105** with the alarm system **100** armed, the alarm system **100** delays raising an alarm for a period of time of about 30 to 120 seconds. This delay provides time for the homeowner to enter a disarming code into the alarm panel **110**, effectively notifying the alarm system **100** that the opening of the front door does not represent a threat. If the alarm system **100** does not receive the disarming code within the designated time, then the alarm system **100** will deem the front door opening as an intrusion and raise an alarm. As will be further discussed below with reference to FIG. **3**, process **200** includes a sub-process for detecting tampering that could interfere with the alarm system's intended procedure for handling time delay sensors **115**.

At step **205** of process **200**, the homeowner arms the alarm panel **110**, for example as the homeowner exits the home **105** on the way to work in the morning.

At step **210** of process **200**, the alarm panel **110** notifies the server **120** that the alarm system **100** is armed. Accordingly, the server **120** monitors for any alarm data transmissions originating at the home **105**.

At step **215**, someone opens the front door and triggers the front door sensor **115**. The person opening the front door might be the legitimate homeowner or an intruder.

At step **220**, the front door sensor **115** transmits to the alarm panel **110** a front-door-open signal or other security-zone-open signal.

At step **225**, the alarm panel **110** receives the front-door-open signal and forwards the signal to the server **225**.

At step **230**, in response to receipt of the front-door-open signal, the alarm panel **110** starts expecting entry of the disarming code within the specified delay, which is typically in a range of about 30 to about 120 seconds, as discussed above. Thus, receipt of the front-door-open signal starts an alarm panel timer.

Receipt of the front-door-open signal at the alarm panel **100** further initiates a tamper detection process at step **260** that FIG. **3** illustrates in flowchart, as discussed below. The tamper detection process of step **260** can run in parallel with other steps of process **200** to facilitate detection of any tampering that may occur during a time delay.

At inquiry step **235**, the alarm panel **110** checks for user entry of the disarming code. If the alarm panel **110** has received the disarming code, then process **200** branches to step **240**.

At step **240**, the alarm panel **110** notifies the server **120** that the alarm system **100** has been disarmed and thus that all is clear. Process **200** then ends.

If the alarm panel **110** has not received the disarming code at inquiry step **235**, then process **200** executes inquiry step **245** rather than step **240**.

At inquiry step **245**, the alarm panel **110** determines whether the time delay has elapsed. In other words, the alarm panel **110** determines whether the timer started at step **230** has reached the time delay and thus expired. If the timer is still timing towards the delay, then execution of process **200** loops back to step **235**. Steps **235** and **245** iterate until the alarm panel **110** is disarmed or the time delay expires.

If the time delay expires before the alarm panel **110** is disarmed, then process **200** executes step **250** from inquiry step **245**.

At step **250**, the alarm panel **110** deems the opening of the front door as an intrusion and raises an alarm. The alarm panel **110** transmits the intrusion alarm to the server **120**.

At step **255**, the server **120** receives the intrusion alarm from the alarm panel **110** and forwards the alarm to the central station **125**. The central station **125** can act on the alarm by dispatching emergency personnel, opening a bidirectional voice channel to the alarm panel **110**, or taking other action as deemed appropriate. Process **200** ends from step **255**.

FIG. **3** illustrates a representative flowchart of a process for detecting alarm system tampering, as implemented at step **260** as a sub-process of process **200**.

At step **305** of sub-process **260**, the alarm panel **110** has received the front-door-open signal (or other security-zone-open signal that may have an associated time delay). In response to that signal receipt, the alarm panel begins transmitting a series of packets to a communication interface of the server **120** using user datagram protocol (UDP) or other high-speed, one-way (i.e. unidirectional) communication schema that has low overhead for efficiency. Thus, the server **120** comprises a communication interface configured for the unidirectional communication. Accordingly, the communication layer operates without needing to transmit a packet-receipt acknowledgement back to the alarm panel **110**. The alarm panel **110** typically transmits the packets on a uniform time period, for example one packet every three seconds. Thus, the alarm panel **110** typically intends consistent time intervals between packet transmissions.

The alarm panel **110** continues the series of packet transmissions until the alarm delay expires or the alarm panel **110** receives a proper disarming code. As discussed above with reference to FIG. **2**, with expiration of the time delay, process **200** branches from step **245** to step **250**, and the alarm panel **110** raises an intrusion alarm. And when the alarm panel **110** receives the disarming code, process **200** branches from step **235** to step **240**, and the alarm panel **110** notifies the server **120** that the alarm system **100** has been disarmed.

At step **310** of sub-process **260**, the server **120** receives the first incoming packet in the series transmitted by the alarm panel **110**. The first packet received by the server **120** is often the first packet sent by the alarm panel **110**. However, the order of packet receipt may differ from the order of packet transmission, for example due to packet switching that occurs in the network, between transmission and receipt. In other words, the individual packets in the series may transmit over different network routes and thus experience different propagation delays.

At step **315** of sub-process **260**, the server **120** transitions to a sleep mode with respect to detecting the incoming packets transmitted by the alarm panel **110** at step **305**. This sleep mode continues for a specified period of time, for example 25 seconds. Thus, the server **120** responds to receipt of the first incoming packet by ignoring any packets that may arrive during a time period of 25 seconds. Ignoring packets frees the computing/processing resources of the server **120** to perform other tasks that may include servicing a larger number of other alarm systems at other premises.

As an alternative to sleeping for a predetermined amount of time, the server **110** may utilize a sleep time that is random. The processor **170** may utilize a random number generator to provide sleep times that vary randomly within a range, for example a random amount of time that is between 20 and 30 seconds.

Inquiry step **320** of sub-process **260** determines whether the sleep time period has expired. If the sleep time period has not expired, then the sleep mode is maintained at step **325** and step **320** repeats. Accordingly, sub-process **260** iterates steps **320** and **325** until the sleep time period is complete. When the sleep time period is over, step **330** executes from step **320**.

At step **330** of sub-process **260**, the server **120** wakes up with respect to monitoring for packets from the alarm panel **110**. The server **120** stays awake for a predetermined period of time, for example between 10 and 20 seconds, and monitors for a packet arrival during that time. As discussed below with reference to steps **335** and **340**, the first packet arrival during that wake time causes the server **120** to revert to the sleep mode.

As an alternative to waking for a predetermined amount of time, the server **110** may utilize a time period that is random. The processor **170** may utilize a random number generator to provide wake times that vary randomly within a range, for example a random amount of time that is between 10 and 20 seconds.

At inquiry step **335**, sub-process **260** branches according to whether the server **120** has received a packet from the alarm panel **110**. If the server **120** has received a packet, then sub-process **260** loops back to step **315**. If the server **120** has not received a packet, then inquiry step **340** executes.

If the wake period has not expired, then step **350** executes, the wake mode continues, and steps **335**, **340**, and **350** iterate until the wake period expires without receipt of a packet.

When the wake period expires without receipt of a packet, then inquiry step **355** executes from step **340**. Step **355** inquires as to whether the sever **120** has received a disarm notification or an intrusion alarm per steps **240** and **255** respectively of process **200**. If the inquiry is negative, then the server **120** determines that an intruder or other person has tampered with the alarm system **100** and issues a panel tamper alarm for transmission to the central monitoring station **125** via a communication interface. The central monitoring station **125** may open a voice channel to the alarm system **100**, dispatch police, or take other action as appropriate.

If execution of step **335** results in a determination that an intrusion alarm has been triggered or that the alarm panel **110** has been properly disarmed, then at step **365**, the sub-process **260** returns to process **200** as discussed above. Return similarly occurs following execution of step **360**. In both cases, the alarm panel **110** ceases transmitting the series of packets.

Technology for tamper detection has been described. From the description, it will be appreciated that embodiments of the present technology overcome limitations of the prior art. Those skilled in the art will appreciate that the present technology is not limited to any specifically discussed application or implementation and that the embodiments described herein are illustrative and not restrictive. From the description of the exemplary embodiments, equivalents of the elements shown therein will suggest themselves to those skilled in the art, and ways of constructing other embodiments of the present technology will appear to practitioners of the art.

What is claimed is:

**1**. A server comprising:

a first communication interface that is configured to receive communications transmitted from an alarm panel, wherein the alarm panel is configured to transmit an arming notification, a disarm notification, an intrusion alarm, and packets transmitted periodically in a unidirectional communication protocol when a sensor connected to the alarm panel is triggered, wherein the alarm panel is further operable to stop transmitting packets in the unidirectional communication protocol when an alarm delay of the alarm panel expires or when the alarm panel is disarmed;

a second communication interface that is configured for bidirectional communication with a central monitoring station;

a processor that comprises:

a first connection to the first communication interface;

a second connection to the second communication interface;

memory; and

processor executable instructions stored in the memory to perform the steps of:

monitoring for the arming notification transmitted from the alarm panel;

monitoring for the disarm notification transmitted from the alarm panel;

monitoring for the intrusion alarm transmitted from the alarm panel;

responsive to receipt of the intrusion alarm, notifying the central monitoring station of the intrusion alarm;

alternating between:

for a first period of time, monitoring the first communication interface for a packet of the packets transmitted periodically in the unidirectional communication protocol from the alarm panel when the sensor connected to the alarm panel is triggered; and

for a second period of time, ignoring the packets transmitted periodically in the unidirectional communication protocol from the alarm panel when the sensor connected to the alarm panel is triggered,

wherein detection of the monitored-for packet of the packets transmitted periodically in the unidirectional communication protocol from the alarm panel during the first period of time suspends the packet monitoring of the first period of time and initiates the second period of time, and

wherein completion of the second period of time without detecting the monitored-for disarm notification and without detecting the monitored-for intrusion alarm initiates a subsequent execution of the first period of time; and

responsive to a completion of the subsequent execution of the first period of time during which the monitored-for packet has not been detected, the monitored-for disarm notification has not been received, and the monitored-for intrusion alarm has not been received, notifying the central monitoring station of an occurrence of a tampering event.

**2**. The server of claim **1**, wherein the first period of time is predefined.

**3**. The server of claim **1**, wherein the first period of time comprises randomness within a range.

**4**. The server of claim **1**, wherein the second period of time is predefined.

**5**. The server of claim **1**, wherein the second period of time comprises randomness within a range.

**6**. The server of claim **1**, wherein the packets transmitted periodically are periodic with a period, and

wherein the first period of time is greater than twice the period.

**7**. he server of claim **1**, wherein the packets transmitted periodically are periodic with a period, and

wherein the second period of time is greater than twice the period.

**8**. The server of claim **1**, wherein second period of time is greater than twice the first period of time.

**9**. The server of claim **1**, wherein the unidirectional protocol is user datagram protocol (UDP).

**10**. A method for detecting tampering of an alarm system, comprising the steps of:

monitoring for an arming notification transmitted from an alarm panel of the alarm system;

monitoring for a disarm notification transmitted from the alarm panel;

monitoring for an intrusion alarm transmitted from the alarm panel;

monitoring for packets transmitted periodically in a unidirectional communication protocol when a sensor connected to the alarm panel is triggered, wherein the alarm panel stops transmitting packets in the unidirectional communication protocol when an alarm delay of the alarm panel expires or when the alarm panel is disarmed;

responsive to receipt of the intrusion alarm, notifying a central monitoring station of the intrusion alarm;

alternating between:

for a first period of time, monitoring for a packet of the packets transmitted periodically in the unidirectional communication protocol from the alarm panel when the sensor connected to the alarm panel is triggered; and

for a second period of time, ignoring the packets transmitted periodically in the unidirectional communication protocol from the alarm panel when the sensor connected to the alarm panel is triggered,

wherein detection of the monitored-for packet of the packets transmitted periodically in the unidirectional communication protocol from the alarm panel during the first period of time suspends the packet monitoring of the first period of time and initiates the second period of time, and

wherein completion of the second period of time without detecting the monitored-for disarm notification during the second period of time and without detecting the monitored-for intrusion alarm during the second period of time initiates a subsequent execution of the first period of time; and

responsive to completion of the subsequent execution of the first period of time during which the monitored-for packet has not been detected, the monitored-for disarm notification has not been received, and the monitored-for intrusion alarm has not been received, notifying the central monitoring station of an occurrence of a tampering event.

**11**. The method of claim **10**, wherein the first period of time is predefined.

**12**. The method of claim **10**, wherein the first period of time comprises randomness within a range.

**13**. The method of claim **10**, wherein the second period of time is predefined.

**14**. The method of claim **10**, wherein the second period of time comprises randomness within a range.

**15**. The server of claim **10**, wherein the packets transmitted periodically are periodic with a period, and

wherein the first period of time is greater than twice the period.

**16**. The server of claim **10**, wherein the packets transmitted periodically are periodic with a period, and

wherein the second period of time is greater than twice the period.

**17**. The method of claim **10**, wherein second period of time is greater than twice the first period of time.

**18**. The method of claim **10**, wherein the unidirectional protocol is user datagram protocol (UDP).

**19**. A system comprising:

an alarm panel configured to perform the steps of:

transmitting an arming notification to a server in response to user entry of an arming command;

transmitting a disarming notification to the server in response to user entry of a disarm notification;

responsive to receiving a signal from a sensor while the alarm panel is armed, transmitting an intrusion alarm to the server if the alarm panel is not disarmed within a first period of time following receipt of the signal; and

responsive to receiving the signal from the sensor while the alarm panel is armed, transmitting a series of packets to the server using a unidirectional protocol; and

the server configured to perform the steps of:

responsive to receiving a packet in the series, ignoring any packets in the series incoming during a second period of time;

responsive to conclusion of the second period of time, monitoring for another packet in the series incoming during a third period of time;

if the another packet in the series is received during the third period of time, then ignoring any packets in the series incoming during a fourth period of time; and

if the another packet in the series is not received during the third period of time, then raising a tampering alarm unless the disarming notification is received during the third period of time and unless an intrusion alarm is received during the third period of time.

**20**. The system of claim **19**, wherein the unidirectional protocol is UDP.

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